DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 5, 2011 has been entered.

2. This Office action is in response to the amendment filed October 5, 2011, which amends claim 29, cancels claims 30, 31, 51, 52, 55, and 57-62, and adds claim 63. Claims 29, 33, 50, and 63 are pending.

Response to Amendment

3. Applicant's amendment of the claims and cancellation of the claims, filed October 5, 2011, has caused the withdrawal of the rejection of claims 51 and 57 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement, as set forth in the Office action mailed May 16, 2011.

4. Applicant's amendment of the claims and cancellation of the claims, filed October 5, 2011, has caused the withdrawal of the rejection of claims 30, 55, 58, 61, and 62 under 35 U.S.C. 103(a) as being unpatentable over Hatwar et al. (US 2004/0185300) in view of Liu et al. (Synthetic Metals 2004, 146, 85-89) and Thomas et al. (Journal of the

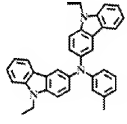
American Chemical Society, year 2001, volume 123, pages 9404-9411) as set forth in the Office action mailed May 16, 2011.

5. Applicant's amendment of the claims and cancellation of the claims, filed October 5, 2011, has caused the withdrawal of the rejection of claims 30, 51, 55, 57, 58, 61, and 62 under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. (US 2004/0124766) in view of Liu et al. (Synthetic Metals 2004, 146, 85-89) and Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411) as set forth in the Office action mailed May 16, 2011.

6. Applicant's amendment of the claims and cancellation of the claims, filed October 5, 2011, has caused the withdrawal of the rejection of claims 31, 52, 59, and 60 under 35 U.S.C. 103(a) as being unpatentable over Hatwar et al. (US 2004/0185300) in view of Liu et al. (Synthetic Metals 2004, 146, 85-89), Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411), and Raychaudhuri et al. (US 2004/0222737) as set forth in the Office action mailed May 16, 2011.

7. Applicant's amendment of the claims and cancellation of the claims, filed October 5, 2011, has caused the withdrawal of the rejection of claims 31, 52, 59, and 60 under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. (US 2004/0124766) in view of Liu et al. (Synthetic Metals 2004, 146, 85-89), Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411), and Raychaudhuri et al. (US 2004/0222737) as set forth in the Office action mailed May 16, 2011.

8. The declaration under 37 CFR 1.132 filed October 5, 2011 is insufficient to overcome the rejection of claims 29, 33, 50, and 63 based upon Hatwar et al. (US 2004/0185300) in view of Liu et al. (Synthetic Metals 2004, 146, 85-89) and Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411) or Nakagawa et al. (US 2004/0124766) in view of Liu et al. (Synthetic Metals 2004, 146, 85-89) and Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411) as set forth in the last Office action because: Liu in view of Thomas shows that the unexpected results would be expected.

9. Liu teaches a carbazole compound with the following structure,  , (DECMA, page 86 right column), which reads on applicant's formula (1), where R^{12} and R^{14} are hydrogen and Ar^{11} is m-tolyl. Liu teaches that these carbazoles can be used in light emitting elements and can be found in hole injection layer (page 86 right column first paragraph under heading 2.3 Fabrication and testing of OLEDS and page 88 left column first paragraph under heading 3.3 EL performances of DECMA-based OLEDs).

10. Thomas teaches a light emitting element comprising a carbazole compound (abstract). Thomas teaches the carbazole compounds can be used in the light emitting layer and teaches the use of the carbazole compounds as hole injection/transporting compounds (page 9404 right compound paragraph at beginning of column). Thomas further teaches that when the N position on a carbazole group is changed from an alkyl

group to an aryl group and used in the hole transporting layer the drive voltage of the device is lower and the efficiency is increased (page 9409 Table 2 compounds 9 and 10 and 11 and 12 and page 9410 Figure 5 examples 11 and 12). Thomas teaches that can lower the drive voltage of a device comprising a carbazole compound in the hole injection/transporting layer by changing an ethyl group that is attached to the N position on the carbazole to an aryl group (page 9409 Table 2 compounds 9 and 10 and 11 and 12 and page 9410 Figure 5 examples 11 and 12).

11. Given the teachings of Liu and Thomas it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the carbazole compound (DECMA) of Liu so the ethyl groups were changed to phenyl groups. The motivation would have been to lower the drive voltage of a device using the compound; therefore, the applicant's observed results of a lower drive voltage when the ethyl group is replaced with a phenyl group is expected.

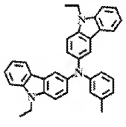
Response to Arguments

12. Applicant's arguments filed October 5, 2011 have been fully considered but they are not persuasive.

13. The applicant's amendment of the claims has caused a reinterpretation of the prior art of record both Hatwar and Nakagawa teaches a light emitting element comprising in order an anode, a hole injection layer in contact with the anode, a hole transporting layer in contact with the hole injection layer, a light emitting layer in contact with the hole transporting layer, an electron transporting layer comprising an electron

transporting material, and a cathode over the light emitting layer (Fig. 3 paragraph [0109] of Hatwar and paragraphs [0082], [0083], [0092], and [0178] of Nakagawa). Both Hatwar and Nakagawa teaches that the hole injection layer can be composed of any known material (paragraph [0040] of Hatwar and paragraphs [0099] and [0107]-[0114] of Nakagawa).

14. While Liu teaches a carbazole compound with the following structure,



, (DECMA, page 86 right column), which reads on applicant's formula (1), where R^{12} and R^{14} are hydrogen and Ar^{11} is m-tolyl. Liu teaches that these carbazoles can be used in light emitting elements and can be found in hole injection layer (page 86 right column first paragraph under heading 2.3 Fabrication and testing of OLEDS and page 88 left column first paragraph under heading 3.3 EL performances of DECMA-based OLEDs). Therefore, the applicant's claimed invention is taught by Hatwar in view of Liu and Thomas and Nakagawa in view of Liu and Thomas and the applicant's arguments are not persuasive.

15. Regarding applicant's arguments of unexpected results, this was addressed above. Liu in view of Thomas teach that the applicant's observed results are expected therefore, the applicant's arguments are not persuasive.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

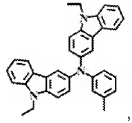
1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

18. Claims 29, 33, 50, and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatwar et al. (US 2004/0185300) (hereafter "Hatwar") in view of Liu et al. (Synthetic Metals 2004, 146, 85-89) (hereafter "Liu") and Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411) (hereafter "Thomas").

19. Regarding claims 29, 55, and 62, Hatwar teaches a light emitting element comprising in order an anode, a hole injection layer in contact with the anode, a hole transporting layer in contact with the hole injection layer, a light emitting layer in contact with the hole transporting layer, an electron transporting layer comprising an electron transporting material, and a cathode over the light emitting layer (Fig. 3 paragraph [0109]). Hatwar teaches the light emitting layer is composed of a host material and a

blue dopant (paragraphs [0059]-[0070]). Hatwar teaches the hole injection layer can be made of any known hole injection material (paragraph [0040]).

20. Hatwar does not teach where the hole injection material is a carbazole compound.

21. Liu teaches a carbazole compound with the following structure,  , (DECMA, page 86 right column), which reads on applicant's formula (1), where R^{12} and R^{14} are hydrogen and Ar^{11} is m-tolyl. Liu teaches that these carbazoles can be used in light emitting elements and can be found in hole injection layer (page 86 right column first paragraph under heading 2.3 Fabrication and testing of OLEDS and page 88 left column first paragraph under heading 3.3 EL performances of DECMA-based OLEDs). Liu teaches that DECMA lowers the hole injection barriers at ITO/DECMA and DECMA/NPB interfaces and consequently facilitates the hole injection at these interfaces (page 88 left column second paragraph under heading 3.3 EL performances of DECMA-based OLEDs).

22. Thomas teaches a light emitting element comprising a carbazole compound (abstract). Thomas teaches the carbazole compounds can be used in the light emitting layer and teaches the use of the carbazole compounds as hole injection/transporting compounds (page 9404 right compound paragraph at beginning of column). Thomas further teaches that when the N position on a carbazole group is changed from an alkyl

group to an aryl group and used in the hole transporting layer the drive voltage of the device is lower and the efficiency is increased (page 9409 Table 2 compounds 9 and 10 and 11 and 12 and page 9410 Figure 5 examples 11 and 12). Thomas teaches that can lower the drive voltage of a device comprising a carbazole compound in the hole injection/transporting layer by changing an ethyl group that is attached to the N position on the carbazole to an aryl group (page 9409 Table 2 compounds 9 and 10 and 11 and 12 and page 9410 Figure 5 examples 11 and 12).

23. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the carbazole compound (DECMA) of Liu so the ethyl groups were changed to phenyl groups. The motivation would have been to lower the drive voltage of a device using the compound.

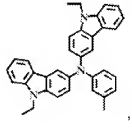
24. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the hole injection layer of Hatwar so the modified compound of Liu was used hole injection layer. Hatwar teaches that any hole injection material can be used and Liu teaches that DECMA is a good hole injection material because it was shown to improve hole injection in an electroluminescent element; therefore, it would have been obvious to one of ordinary skill in the art to use the modified Liu compound as the hole injection material.

25. Regarding claim 33, Hatwar teaches the light emitting element can be used in a light emitting device and the device can be used in a lighting system (paragraph [0005]).

26. Claims 29, 33, 50, and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. (US 2004/0124766) (hereafter "Nakagawa") in view of Liu et al. (Synthetic Metals 2004, 146, 85-89) (hereafter "Liu") and Thomas et al. (Journal of the American Chemical Society, year 2001, volume 123, pages 9404-9411) (hereafter "Thomas").

27. Regarding claims 29, 50, and 63, Nakagawa teaches a light emitting element comprising in order an anode, a hole injection layer in contact with the anode, a hole transporting layer in contact with the hole injection layer, a light emitting layer in contact with the hole transporting layer, an electron transporting layer comprising an electron transporting material, and a cathode over the light emitting layer (paragraphs [0082], [0083], [0092], and [0178]). Nakagawa teaches the light emitting layer can be composed of a host material and a blue dopant (paragraphs [0141]-[0159]). Nakagawa teaches that the hole injection layer can be composed of any known material (paragraphs [0099] and [0107]-[0114]).

28. Nakagawa does not teach where the hole injection layer is composed of a carbazole compound.

29. Liu teaches a carbazole compound with the following structure,  , (DECMA, page 86 right column), which reads on applicant's formula (1), where R^{12} and R^{14} are hydrogen and Ar^{11} is m-tolyl. Liu teaches that these carbazoles can be used in

light emitting elements and can be found in hole injection layer (page 86 right column first paragraph under heading 2.3 Fabrication and testing of OLEDS and page 88 left column first paragraph under heading 3.3 EL performances of DECMA-based OLEDs). Liu teaches that DECMA lowers the hole injection barriers at ITO/DECMA and DECMA/NPB interfaces and consequently facilitates the hole injection at these interfaces (page 88 left column second paragraph under heading 3.3 EL performances of DECMA-based OLEDs).

30. Thomas teaches a light emitting element comprising a carbazole compound (abstract). Thomas teaches the carbazole compounds can be used in the light emitting layer and teaches the use of the carbazole compounds as hole injection/transporting compounds (page 9404 right compound paragraph at beginning of column). Thomas further teaches that when the N position on a carbazole group is changed from an alkyl group to an aryl group and used in the hole transporting layer the drive voltage of the device is lower and the efficiency is increased (page 9409 Table 2 compounds 9 and 10 and 11 and 12 and page 9410 Figure 5 examples 11 and 12). Thomas teaches that can lower the drive voltage of a device comprising a carbazole compound in the hole injection/transporting layer by changing an ethyl group that is attached to the N position on the carbazole to an aryl group (page 9409 Table 2 compounds 9 and 10 and 11 and 12 and page 9410 Figure 5 examples 11 and 12).

31. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the carbazole compound (DECMA) of Liu so the ethyl

groups were changed to phenyl groups. The motivation would have been to lower the drive voltage of a device using the compound.

32. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the hole injection layer of Nakagawa so the modified compound of Liu was used hole injection layer. Nakagawa teaches that any hole injection material can be used and Liu teaches that DECMA is a good hole injection material because it was shown to improve hole injection in an electroluminescent element; therefore, it would have been obvious to one of ordinary skill in the art to use the modified Liu compound as the hole injection material.

33. Regarding claim 33, Nakagawa teaches the light emitting element can be used in light emitting devices and these devices emit white light emit and can be used in a full-color display (a lighting system) (paragraphs [0001] and [0053]).

Conclusion

34. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANDREW K. BOHATY whose telephone number is (571)270-1148. The examiner can normally be reached on Monday through Thursday 8:00 am to 5:30 pm EST and every other Friday from 8:00 am to 4:30 pm EST.

35. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Chriss can be reached on (571)272-7783. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

36. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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